Evaluating Japan's Decline in the PC Industry: An Institutional Approach

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Introduction

Through a sketch of the technology developmental history for Japan, it is discussed how the unique state-society relations and organizational strategies in Japan affected the formation of formal and informal institutions concerning the development of the IT hardware industry in which the state and societal actors interact with each other. It will be argued that the state has played an inconsistent role not because of the strong and autonomous state that was envisioned by the early statist literature, but because of the institutional strategies and state-society-business relations that are unique to the political economy of the accelerated industrial catch up strategy for IT in Japan. In contrast to Japan, some countries like Taiwan literally built the whole IT sector in the beginning but then relinquished most control to entrepreneurs as soon as possible. States like Taiwan also built an enhanced version of a highly diverse free market "rules of the game" system which unlike Japan and South Korea, did not grant exclusive privileges and monopolies to certain large firms but rather built a transparent and level playing field embracing both small and large enterprises and accountability.

Another point is the problem of bureau pluralism in Japan as opposed to open pluralism which promotes full competition and accountability for all institutions based on results not connections. Some countries avoided bureau pluralism by embracing an openly pluralistic institutional strategy that involved the privatization of government research institutions and the spinning off of almost all state run programs into the private sector in order to create the fullest possible diversity of human resources, competition and transparent accountability. Japan seemed to have all the ingredients for success in the PC era, from strong manufacturing skills and control of many key components technologies to a corporate structure that could support a sustained drive

into export markets.

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Yet in spite of Japan's success in components and peripherals, the Japanese computer makers have had only limited success in PCs, and have been virtually shut out of the software industry. The reasons for this mixed record are complex, yet the most important have to do with Japan's institutional and political structure or "rules of the game".

Part I. The Theoretical Basis for Analysis

1.1 Flexible Production Strategy and Other Arguments

Some researchers such as Piore and Sabel (1984 pp.1-33) and Friedman (1988 pp.16-45) provide an excellent study on the Japanese machine tool industry in applying their theoretical arguments. According to Friedman, both the statist and anti-statist (mostly neo-classical) explanations cannot explain the Japanese economic growth properly. Instead Friedman focuses on the flexible production strategy that has been adopted by Japanese machine tool manufacturers and the effects of politics on specific industrial outcomes. Politics is viewed as "the fundamental orientation people possess about justice, appropriate behavior, and rights throughout society" (Friedman 1988 p.17). Politics is an important concern in the study of industrial outcomes because it shapes the whole industrial order including the market. Thus the Japanese market is not the same as that of the United States. In order to understand the Japanese market properly, one has to consider the historical and political contexts through which the market is shaped. The substantial role of small and medium sized enterprises whose estimated market share was about 70 per cent of the Japanese machine tool production, and the flexible production strategy adopted by them are cited as good evidence for MITI's inability to control the machine tools industry. By and large flexible production strategy and politics in the machine tools industry, rather than the invisible hand of the market or the visible hand of the state (MITI), are responsible for the success of the

Japanese machinery industry, argues Friedman.

Global Division of Labor and Production Network Arguments

Another revisionist argument about the sources of East Asian development can be called the "global division of labor and production network arguments," which emphasizes the ways that East Asian late developers are incorporated into the regional and global division of labor. The advocates of this view pay special attention to the fact that technologies and industries at the mature stage usually transferred from the advanced industrial countries to late developers in the forms of foreign direct investments, off-shore manufacturing, and original equipment manufacturing production. To the governments of East Asian countries, this was viewed as a good opportunity to develop themselves, and thereby they tried to induce as much foreign investment as possible. Local capitalists and MNCs interact with each other in order to utilize this opportunity, and with the economic bureaucrats of the host countries, and domestic and international financial institutions. By doing so, East Asian countries were incorporated into the international division of labor and became a part of the international economic structure. The complex interplay among governments, local capitalists, and MNCs under the differing international political economic conditions and structures is analyzed as to how it affects the relative economic performance among different countries.

The "flying geese model" argued by Akamutsu (1962 pp.3-25) can be viewed as a classic example in this view. Cumings'(1984 pp.12-56) well-known article about product life cycle and geopolitics is also a typical example, which argues the ways that product life cycle and geopolitical advantages are utilized by East Asian countries in achieving economic development. Similarly, Henderson (1989 pp.1-66) points out the importance of state intervention in the market at a time when foreign investments are coming into the developing countries. Though Bernard and Ravenhill (1995 pp.171-197) criticize the flying geese model of Akamutsu (1962 pp.3-25) and the product life cycle argument addressed by Cumings (1984 pp.12-56), they also pay much attention to the existence of regional production network centered on Japan in explaining the development of the electronics industry in East Asia. Likewise, Gereffi (1994 pp.1-22, 1996 pp.75-112) emphasizes the impacts of global commodity chains upon East Asian economic success.

1.2 Towards Understanding CIA

The state seldom remains as developmental, anti-statist, or corporatist in the policymaking and implementation process over time, not only because of the dynamic state-society relations but also because of the bureaucratic politics within the state that greatly affects the actions of the state which exercises some transformative power over the " rules of the game " operating within the society. The institutions of the industrial structure, the strategies adopted by major producers, and the people involved in sectoral politics are not necessarily the same through time (see for example, Friedman 1988 pp.1-134) so that the state in one sector may play radically different roles in other sectors (see for example, Krasner 1978 pp.34-127). To make things more complex, changes in international political economy may provoke a radical shift in the role of the state in industrial adjustment (Haggard and Kaufman 1992 pp.1-22), especially in the economies that are heavily dependent upon international trade such as Taiwan and Japan. But the adjustment strategies are not necessarily the same due in part to the different domestic political economic structures represented as the rules of the game. (see for example, Stallings 1992 pp.41-86 and Kahler 1992 pp.89-138). Just like the liberal economic regime during the 1950s and 1960s provided good chances to East Asian late developers, the neo-protectionist tendency of the advanced industrial countries after the 1970s has imposed significant constraints upon the same group of countries.

The existing literature on East Asian development provides unique sets of explanations about the role of the state in the process of development and the ways that industrial policies are shaped. They argue that industrial policies are the direct outcomes of the structures and actions of the state (the statist approach), of free market competition and utility maximization among interest groups and/or various market factors (the anti-statist approach), of concentration of interests between the state and capitalists without the participation of labor unions (developmental corporatism), of embedded autonomy of the state-society relations (embedded autonomy argument), of distinctive sectoral politics and production strategies as in Friedman (1988 pp.1-98), or of global division of labor and production networks.

According to Evans, Stephens, and 青木 etc. a new comparative institutional approach to political economy has emerged since the 1960s as a Lakatosian and Von Neumannian research program in the course of theoretical conflicts between major paradigms in the study of development, including modernization theory, dependency

and world-system approaches, as well as the works of neo-Marxists and Third World scholars. They say:

> Its practitioners constitute a community of scholars who share important heuristic assumptions ... They attack a variety of substantive issues and are eclectic in their methodology but share a number of characteristics that in combination serve to distinguish them from earlier work ...the contemporary work on which we focus begins with the conviction that economic and political development cannot fruitfully be examined in isolation from each other. It has absorbed the lessons that grew out of work on dependency and world-system perspectives and is therefore much more sensitive to international factors than classic political economy, but it has rejected the idea that external factors determine the dynamics of domestic development. More generally, *it rejects models that posit "necessary" outcomes, assuming instead that developmental paths are historically contingent*. Multiple cases are preferred and when single cases are used they are set in a comparative framework. Quantitative and other cross-sectional data are located in the context of more historical evidence. (Evans and Stephens 1988b pp.713-4; italics added)

According to this new comparative institutional approach to political economy, the state is "an organization which, since it cannot be otherwise than a social network of people, exists in its own right and possesses interests of its own" (Cardoso 1979, 51).

1.3 The Role of State Institutions and "the Rules of the Game".

The role of the state apparatus in development "must be considered along with the interaction of social classes if the politics of development is to be explained" (Evans and Stephens 1988b p.723). Domestic class structure and industrial structure, as well as the ways that interests are represented in a given society are the outcomes of historically contingent interactions between the state and society. The degree of state intervention is not constant but variant through time and space. As to the effects of international contexts upon domestic development, the new comparative political economy emphasizes:

> Instead of seeing the international system as determining the possibilities for national development the new comparative political economy takes a more recursive view in which the world political economy both shapes and is shaped by the historical trajectories of development within individual nation states. Further complexity is introduced by bringing geopolitics back into the traditionally economic analysis of core-periphery relations. (Evans and Stephens 1988b p.725)

In short, a new comparative political economy views the state and state-society relations as historically and structurally variant, and thus the international system as well as geopolitics have an impact upon the rules of the game and policy-making

process. Thus the state in this view cannot be reduced to an aggregation of individuals who possess certain positions within the bureaucracy at a particular time, and the policy outcomes cannot be reduced to the results of individual utility maximization regardless of time and space. Evans points out this very clearly:

> In the comparative institutional approach, the state is seen as a historically rooted institution, not simply a collection of strategic individuals. The interaction of state and society is constrained by institutionalized sets of relations. Economic outcomes are the products of social and political institutions, not just responses to prevailing market conditions. Understanding diverse outcomes is the aim, not forcing cases into a generic mold or onto a one-dimensional scale. (Evans 1995 p.18)

Let us take some examples to see how the works on East Asian development could be viewed as the application of a new comparative political economy deal with the state and state-society relations in the process of development as well as in the industrial policy-making process. Chu (1987 pp.188-255) in his study on different adjustment strategies taken by the East Asian NICs during the 1970s and early 1980s, argues:

> First, domestic structural arrangement can be an important source of national economic strategies even for countries that are constrained by limited domestic markets and highly dependent on external trade. Secondly, in state-dominated societies, the locus of domestic policy determinants lies in the public realm. In accounting for state policy responses at moments of international crises and changes, we should turn attention to the strategic behaviors of the government elite positioned in a distinctive state structure, with different policy tools and institutional resources at their disposal. (Chu 1987 p.245)

As shown above, it is clear that the role of the state can vary according to the structural constraints, both domestic and international, imposed upon the state and state-society relations.

Though Samuels (1987 pp.234-279) views reciprocal consent as a major state-business relation in Japanese energy politics, he does not have a theory of the state different from that of other studies that could be viewed as the application of the new comparative political economy. He argues that " state intervention would be enhanced by six factors: market structure, centralization, developmental timing and finance, openness to diversity, the nature of the ruling coalition, and administrative tradition " (Samuels 1987 p.265). He further argues:

> " understanding the Japanese policy process requires a prior appreciation of political conflict within and across subgovemments rather than direct confrontation between unified actors. Some have termed that process " reciprocal consent, " a formulation not completely inconsistent with Japan, Inc. To the extent that it can accommodate diversity and conflict, and

> to the extent that it can be disaggregated, Japan, Inc., may yet be the most elegant characterization of the Japanese political economy." (Samuels 1987 p.288)

From this quote, it is clear that the Japanese state has been corporative with businesses in conducting industrial policies for the energy sector, not because of the constant state-business relations as such but because of the structural conditions in which the state, state institutions, and the business have been located. The same is also true in Okimoto (1989 pp.219-238) who argues:

> Industrial policies for steel, lasers, and ICs pose a sharp contrast to those for agriculture, food processing, and construction. The differences can be attributed largely to variations in the patterns of interest aggregation involving the LDP, producer groups, and bureaucratic agencies. (Okimoto 1989 p.229)

Likewise, Gereffi (1994 pp.1-16) argues that the key of East Asian industrial success is neither the state nor the market. Rather it is the combination of organizational learning, openness to diversity and institutional responses by local firms and states to the ever-changing global commodity chains. Multi-layered production and marketing networks that have been provided by the manufacturers and retailers in the advanced industrial countries are major chances which allows East Asian NICs successful entry into the proper positions in global commodity chains.

In contrast to the "old" studies that tend to freeze in time the state and state-society relations in the process of East Asian development, the studies that are categorized as the application of a new comparative political economy rely on the same or similar theory of the state, which can be broadly defined as the capitalist theory of the state. That is, the state is an organization that exists in its own right and possesses interests of its own. What matters to the researcher who wants to explain the role of the state and other actors in the policy-making process are the structural conditions or so called "rules of the game" that limit or encourage the state and other actors in society to experiment with the diversity of trying different roles in the developmental process. Those structural conditions may include the distribution of power between classes, the degree of state autonomy and capacity, the degree of centralization of employers' associations and labor organizations, industrial structure, openness to diversity and experimentation, import/export controls, the alliances between the local entrepreneurs and MNCs, the relative position of a country in the international political economic system, and the geopolitical advantages and disadvantages that go along with

that position.

1.4 Foundations of Comparative Institutional Analysis

The institutional approach is not a totally new analytic framework. The effects of institutions upon state actions have been a major analytic focus of neo-Marxist scholars. It has been advocated by many neo-Marxists that the structural arrangements or rules of the game in the capitalist economy help to perpetuate the dominance of the capitalist class by structuring the behavior of state managers (Miliband 1969 pp.78-145; Poulantzas 1969 pp.78-179, 1978 pp.95-145; Offe 1974 pp.31-57, 1984 pp.34-99; Jessop 1977 pp.353-373, 1982 pp.112-179). Recently some studies on East Asian development begin to pay much attention to institutions in examining national differences. For instance, in his study of the developmental process of the East Asian NICs, Haggard argues,

> Their [state elites] freedom of maneuver depends, however, on institutional setting and the organizational resources they have at their disposal. Three dimensions of the state as an institutional and legal structure bear on the ability of political elites to realize their interests. The first is degree of insulation from societal pressures, which in turn is a function of the institutional arrangements linking state and society. The second is cohesiveness of the decision-making structure itself. The third is instruments that are available to state elites in pursuing their political and substantive goals. Variations in these institutional characteristics influence policy choice and implementation. (Haggard 1990 pp.43-4)

Understanding institutional differences, therefore, is crucial to explaining the cross national differences in policy outcomes. While the institutional approach has distinctive merits in explaining historical, sectoral, and cross-national variations in policy outcomes, it is also subject to drawbacks. One possible criticism is that the institutional approach is nothing more than a synthesis or summing up of what various existing approaches say. This is in a sense valid because institutions include not only state structures but also norms and standard operating procedures in which various societal actors interact with each other. Institutions also include international contexts that delimit the interactions between players. In this sense, the institutional approach certainly loses theoretical conciseness. However considering the utility of the institutional approach, that is, its explanatory power in dealing with historical, sectoral as well as cross-national and temporal dynamics, the sophistication of institutional analysis may not be a serious theoretical weakness. Moreover when we analyze the cross-national variation in policy outcomes of IT hardware policies in this particular study, we in fact examine only the relevant differences rather than all institutions, which can relieve the complexity

problem to a certain extent.

Professor Aoki Masahiko has explained how the effective management of Japanese firm organization that endogenizes contextual skill formation has been supported by the complementarity of the contingent governance structure and the imperfect labor market. He argues that the contingent governance structure in turn has been supported by regulations restricting entry to many industries that have made it possible for these industries, such as main banks, to accrue rents. In Aoki ś words:

> The regulation of entry into an industry and the protection of weak firms in disadvantaged industries has been one of the primary institutional elements sustaining the Japanese economy. By committing to the protection of the human capital value of the specific skills formed in each industry, they have provided economic agents with incentives to invest in contextual skills.. In Japan, most working people in all fields have been expecting the value of their human capital to be maintained through a multilayered structure comprising their employing firm, the industrial associations in their industry, and the ministry that oversees that industry. In my book published in 1988, this system was referred to as " bureau pluralism. The term " bureau " originally referred to a " drawer " and implied sorting or arranging something. The bureaucracy has played an important role as agent and arbitrator in protecting the vested interests of pluralistic groups in different fields. However, " bureau pluralism " is not an " open pluralism " as vested interests protected by bureaucratic administrative mediations merely coexist and various organizational modes cannot be freely created. This joint gain by all parties was made possible by the existence of quasi-rents acquired from the international market by upgrading the machine manufacturing industry, which accounts for 80 percent of exports. It was maintained by distributing the quasi-rents attained by the internationally advanced sectors to the underdeveloped sectors through such mechanisms as domestic price distortion, taxes and subsidies, and entrance regulations.
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> If the learning or transplantation of these organizational innovations is combined with low cost factors of production overseas, the potential for the Japanese economy to acquire quasi-rents will rapidly decline. This trend will be further accelerated by organizational innovations or the emergence of new industries in other countries. In a previous work I referred to the following phenomenon as the " fundamental dilemma of bureau pluralism ": advanced sectors that do not need bureaucratic protection tend to drift away from the bureau pluralistic framework, while less developed sectors tend to rely on it more. ' As long as the acquisition of quasi-rents from the international market by the former is possible, the size of the pie that can be distributed among interest groups will expand, so that the maintenance of bureau pluralism will not be especially problematic. It may even contribute to social stabilization. (Aoki 2000 pp.129-131)

However, Aoki claims that if quasi-rents move toward extinction for the various reasons given above, the framework of bureau pluralism itself will be difficult to maintain. At that point he says that if comparatively disadvantaged industries seek continued protection, the advanced firms would either lose their competitiveness due to higher subsidization to disadvantageous sectors and interest groups, or would be under

great pressure to move their manufacturing bases overseas to survive. The resulting dilemma would be that the only remaining employment opportunities would be in comparatively disadvantaged industries.

Aoki argues that, from the perspective of information processing, there is potential for the economy to continue to demonstrate efficiency in industries that can be characterized as high engineering industries. He also points out that a fairly high possibility that new innovations will be implemented domestically in cross-industrial technologies, such as formation technology driven electronic machinery, retail and service sector networking, and environmental management technologies. However, the dilemma of bureau pluralism might grow more serious, threatening the loss of international competitiveness of the leading industries according to his argument. How should this be handled? Aoki says:

> The combined effect of such factors as the bounded rationality of individuals, evolutionary pressures, and institutional complementarity is a tendency for a more or less homogeneous organizational convention to be adopted throughout a particular economy. However, different organizational conventions will evolve in different nations. This is an unintended outcome of the workings of bounded rationality. This chapter has made it clear that the potential gains from organizational diversity cannot be fully realized on a global scale merely through free trade. This is a proposition that stands even if we assume a purely theoretical situation in which all resources can be traded and there are no costs involved in transportation, storage, etc. If we acknowledge the existence of resources or services that cannot be traded, the proposition gains even more credence.
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> In Ricardian classical trade theory, the primary source of comparative advantage within an economy is the relative quantities of the "primary factors of production" - land, labor, and capital - which cannot themselves be moved between countries. The world can enjoy the gains of trade by first converting these factors of production into outputs that can be traded. What has been emphasized here, however, is that a world comprised of boundedly rational individuals can reap economic gains because of the diversity of "organizational modes," a human construct. Theoretically, these could have been constructed by human intent anywhere, at any time. (Aoki 2000 pp.131-32)

Establishing a new organizational mode different from the prevailing convention is not so simple regardless of whether it is a creative innovation or a transplant from outside. The skill types needed to sustain a new organizational mode may not be readily available in the economy, and the institutional structure supporting the existing organizational mode may not be conducive to experimentation with mutant modes. Aoki says this places an exceptionally heavy burden on the Japanese economy, where bureau pluralism has been implemented, because tall barriers have been constructed to obstruct new entrants. By contrast, economies that have a regulatory stance is to allow

free entry into industries, such as under the Anglo-American system, have institutional structures that are more tolerant of experimentation with mutant organizational modes.

Part II. Political Intervention: Leadership, Politics and IT Policy in Japan

2.1 Intervention Japanese Style

This part considers the reasons for Japan's successes and failures in the PC era but leave some troubling questions. For instance, why were Japanese companies slow to recognize the importance of the PC, remaining fixated instead on the mainframe industry and IBM during the period of 1985-92? Why did MITI fail to stimulate a new wave of start-up companies to compete in the wide-open early days of the PC industry? Why has Japan been almost uniformly unable to develop an independent software industry even though MITI and many consortiums poured a lot of money into their software strategy? And why did most Japanese companies concentrate on the small Japanese PC market and make only halfhearted attempts to penetrate foreign markets?

The answers to these questions are complex, and they go to the heart of Japan's industry structure's rules of the game and corporate culture lack of diversity strategy. The size, diversification, and vertical integration of Japan's computer makers are advantages in producing high-volume hardware products with stable technologies and long product cycles, but they are a liability in the PC industry, with its unpredictable market and technology shifts. Also, the hardware orientation of Japan's electronics industry has meant that software is not given the prominence it deserves, given its critical role in establishing technology standards. Finally, Japan's educational system has been very good at turning out a skilled manufacturing workforce, but it tends to stifle the kind of creativity and initiative that is needed in the innovation-driven segments of the industry as well as the white-collar sector.

A final question: Why did the bureaucrats who had guided Japan's mainframe industry fail to come up with a successful strategy to help Japan compete in the PC era? This question becomes even more cogent when we look at the highly effective government policies employed in Singapore and Taiwan that helped those countries become important centers of PC production. To consider these issues in more detail, we look first at Japan's industry structure and business strategies, and then review the industrial policies employed by the Japanese government during the PC era.

Industry Structure

Japan's industry structure and corporate culture made it difficult for Japanese companies to recognize and respond to the PC revolution. While constant churning of people and companies marks Silicon Valley, Japan is marked by stability. The same companies that created Japan's computer industry in the 1960s still dominate in the 1990s. Stability might be desirable in a mature industry such as automobiles or even mainframe computers, but in a dynamic environment like the PC industry, it can be synonymous with stagnation. It is not simply the size of Japan's computer giants that makes it difficult for them to compete in PCs, but their tendency toward vertical integration and bureaucratic decision-making. Worse yet is their ability to lock newcomers out of the domestic market, preventing the emergence of a new wave of entrepreneurial PC-oriented companies like those in the United States, Taiwan, and elsewhere.

2.2 Japan and the PC Revolution

The personal computer revolution appeared to offer a tremendous opportunity for Japan. Combining their strengths in electronic components with their growing capabilities in computer technology, the Japanese computer makers appeared likely to become major competitors in the global PC industry. In fact, some in the United States expected that Japanese companies would eventually use their control over upstream components and technologies to dominate the industry. Former U.S. Trade Representative Clyde Prestowitz, predicted that the Japanese would run away with the world computer market. Intel's Andrew Grove predicted that Japan would overtake the United States as the dominant world supplier of computer systems by 1992. What few suspected was that the PC revolution would so change the nature of the computer industry that many of the presumed strengths of the Japanese companies would turn out to be liabilities in the PC industry.

Japanese companies did succeed in controlling the market for many PC components and peripherals, including DRAMs, flat-panel displays, and floppy disk drives, as well as many key subcomponents and materials. But for the most part they failed to build on those strengths to compete in the PC systems market. They were also unable to use their strength in DRAMs and other semiconductors as a base for challenging Intel's dominance in microprocessors and were locked almost entirely out of the PC software

market. While Japan's computer hardware production grew rapidly, its companies were largely relegated to the decreasing returns segments of the industry.

Japanese companies are still world leaders in many components and peripherals, but aggressive competitors elsewhere in Asia have challenged their leadership. In 1996, a decade after driving Intel and other U.S. companies out of the DRAM business, Japan was passed by Korea as the leading producer of DRAMs. Korea's electronics companies were also gearing up for a challenge in flat-panel displays, another Japanese stronghold. Meanwhile, Taiwan had become so adept at producing PCs and components that Japan's computer makers were outsourcing production to Taiwanese OEMs to cut costs and get products to market more quickly. Japan's problems were reflected in a steep decline in computer production in the early 1990s, reversing a decade of rapid growth. Total output declined by 20% from 1991 to 1993, before rebounding slowly from 1994 to 1996. Most dramatic was the decline in mainframe production, as the shift from mainframes to PCs finally hit the Japanese market. Much of the short-term decline in production can be attributed to the stagnation of the Japanese economy in the aftermath of the "bubble" economy of the late 1980s. Economic growth hovered around 1 % per year from 1992 to 1995, and the Japanese computer industry, heavily dependent on the domestic market, was especially hard hit. The domestic downturn also forced Japanese components manufacturers to reduce investment just as they were facing increased competition from U.S. and Asian competitors.

While mainframe and minicomputer companies around the world were victims of the PC revolution, in the United States their decline was compensated for by the rapid ascent of new PC-oriented companies such as Apple, Compaq, Dell, Microsoft, Novell, and Lotus. The problem for Japan was that its decline in computers was systemic. The handful of large companies that control most of Japan's computer industry all faced serious downturns in the 1990s, and there were few newcomers to take up the slack. And while IBM was able to reverse its fortunes through a painful restructuring and by shifting focus to emphasize its service and network businesses, the Japanese giants were hamstrung in their efforts to shift course by practices such as lifetime employment and seniority-based promotion. These practices-along with Japan's egalitarian educational system and emphasis on incremental improvement-were well suited to stable, decreasing returns manufacturing businesses, but they were liabilities in the unpredictable, rapidly changing increasing returns world of the PC industry.

2.3 History of Japan's PC Industry

Japan's PC industry developed in parallel with the global industry, but for well over a decade did not converge with it. The first 8-bit Japanese PCs were introduced in the mid-1970s soon after the first Altairs, Apples, and Commodores, and as in the United States, a variety of incompatible architectures competed in the market. But in the 1980s, while the United States and the rest of the world were standardizing on the IBM-PC architecture, with corresponding growth and competition in all segments of the industry, Japan remained a backwater of incompatible standards, high prices, and slow growth.

The fragmentation of the domestic market was due in part to the complexity of the Japanese written language. Japanese PCs had to be able to input, store, display, and print around 6,000 kanji characters, compared to about 200 for European languages. This meant that IBM PC-compatible computers lacked the power to handle the complex Japanese language without special hardware until the 80486 generation of microprocessors became available in the late 1980s.

Table 2.1 Computer Hardware Manufacturing Market Share: Japan, Taiwan, Korea 1995 and 2000 Compared. % of World Market.

	% Share (in units)	% Share of products.	Global	Production (in units)	for various	($ Value) %	($ Value) %
Region	Desk PC	Notebook PC	Monitors & LCDs	Mother Boards	Hard Disk	ICs& related	SRAM & Flash
	95……2000	95……2000	95……2000	95……2000	95……2000	95……2000	95……2000
Korea	5…… 9%	1…… 3%	19……31%	0…… 2%	3…… 6%	7…… 5%	30……36%
Taiwan	10……17%	28……51%	30……33%	68……78%	n.a.	4……14%	2……11%
Japan	6…… 5%	37……27%	40……34%	5…… 5%	30……27%	31……20%	38……29%

Sources: (Institute for Information Industries (MIC/III), Asia IT Report (February 1996 and November 1996); Electronics Industries Association of Korea (EIAK), 1995 Statistics of Electronic Industries (Seoul: EIAK, 1996 pp.34-87); ITRI Statistics 1995 & 2000 pp.65-98; 工業技術研究院 2001 pp.78-113. (compiled by author) * Large companies and government agencies include merchant sales only. Does not include captive production by PC vendors.

The high cost of PCs kept demand low, and Japan's PC penetration level remained about one-third that of the United States well into the 1990s. The demand for PCs was also limited by the difficulty of using DOS-based Japanese PCs. Typing kanji characters on a keyboard requires multiple keystrokes and choices among different characters to represent the correct meaning among homonyms (which are very common in the Japanese spoken language). Rather than buy PCs, many users opted for specialized word processing machines designed to handle Japanese text more easily. Several developments changed the face of the Japanese PC market in the 1990s, however. One was the availability of more powerful microprocessors capable of doing higher-level tasks that previously were handled by mainframes, such as financial analysis and database management. These processors were also able to handle Japanese characters directly in the operating system more easily, making possible three major developments in the Japanese software market.

Under the combined assault of Apple and U.S. vendors selling DOS/V machines, NEC's market share began to erode, from 52% in 1991 to 43% in 1994 (table 3-2). Fujitsu, Toshiba, and Seiko Epson also lost ground, while U.S. companies grabbed a 30% market share. The Japanese market had been cracked open by the efforts of IBM, Compaq, Apple, and Microsoft, which had done in computers what U.S. trade negotiators had struggled to accomplish in other sectors. However, the Japanese companies were not ready to capitulate in their home market, and in 1995 Fujitsu launched its own price war, leaving both NEC and the U.S. vendors reeling.

Compared to the tremor in the market caused by "Compaq shock," "Fujitsu shock" was a major earthquake. Fujitsu cut prices so low that many analysts claimed the company was losing hundreds of dollars on each PC it sold (a claim refuted by Fujitsu, which argued that those estimates included initial investments in marketing, distribution, and product development). And while limited distribution channels and lack of brand name recognition hindered Compaq, Fujitsu was able to mobilize its vast Japanese distribution system to challenge NEC. Fujitsu introduced a rash of new low-cost models, many of which were sourced from Taiwan to cut costs and quickly ramp up volume. The result was a leap in market share from just 9% in 1994 to 18% in 1995 and 22% in 1996. Some of Fujitsu's gains came at the expense of Apple, whose more general corporate problems were spilling over into Japan, but most of the gains came at the expense of NEC, whose market share dropped to 33% in 1996. By 1996, NEC

announced that it would begin selling DOS/V machines in Japan via its Packard Bell/NEC subsidiary, in effect acknowledging that the PC-98's days were numbered. The other impact of Fujitsu shock was a boom in PC sales. Interest in PCs was spurred by a multimedia fad in 1994 and Internet fever in 1995, and as prices fell, demand soared. Japan's PC market grew from 3.2 million units in 1994 to more than 8 million units in 1996, as Japanese businesses finally embraced the PC.

Table 2.2 Revenues and Profits of IBM and Japanese Computer Makers

(In US$ Millions)

	1990	1991	1992	1993	1994	1995
IBM Revenues	65,958	60,479	59,657	57,778	62,065	69,473
Profits	5,719	-2,827	-6,870	-7,506	2,784	3,975
NEC Revenues-computer	10,145	13,033	13,234	14,452	15,700	18,365
Profits-corporate '	580	370	120	-375	70	700
Fujitsu Revenues-computer	17,890	17,839	20,047	20,738	23,514	28,283
Profits-computer	440	338	21	-92	-583	911
Amdahl Revenues	2,159	1,703	2,525	1,681	1,639	1,516
Profits	184	11	-1	-35	75	29
Hitachi Revenues-computer	1,166	10,290	11,352	11,700	14,673	15,672
Profits-corporate '	1,703	1,091	666	634	1,280	1,337

Sources: McKinsey & Company, The 1993 Report on the Computer Industry; The 1994 Report on the Computer Industry; and The 1996 Report on the Computer Industry (New York: McKinsey & Company, 1993, 1994, and 1996); Datamation, The Datamation 100 (June 15, 1996, and June 15, 1993); Electronic Business Asia (various issues 1994-1997) (compiled by author).

' Separate computer industry net income data not available for NEC and Hitachi

U.S. companies, who unified the Japanese software market and introduced price competition, yet the consequences for those companies have been mixed, largely instigated the revolution in Japan's PC market. Microsoft has been the biggest winner, enjoying rapid growth in demand for its operating systems and applications, while Intel has likewise benefited from growth in demand for its microprocessors. For IBM and

Compaq the results have been more ambiguous. Neither was able to make major inroads into the Japanese PC market, and their growth in sales volume was balanced by shrinking profit margins caused by Fujitsu's price war. More ominously, the challenge in their domestic market has led Japan's PC makers finally to become serious about competing in the global market where Compaq and IBM are the leaders.

Besides the role of U.S. companies in shaking up Japan's PC industry, the biggest story in recent years was Fujitsu Shock. Why did this stodgy mainframe vendor suddenly leap into the PC era with such an atypical strategy for a Japanese company? The most plausible answer, and one that is supported by discussions with a few Fujitsu managers, points to the decline in the mainframe business, which accounted for about 40% of Fujitsu's revenues in 1992. Having gone into the red, and seeing its subsidiaries Amdahl and ICL in similar trouble, Fujitsu responded with an all-out price war to buy market share in the PC industry. The company felt that it could only compete by increasing its sales volume and gaining the economies of scale enjoyed by IBM, Compaq, and others. For the longer term, it targeted the export market, but initially it could get the biggest impact in the domestic market, where it could deploy existing production and distribution channels to rapidly increase its sales volume. By 1996, PC prices had begun to stabilize and Fujitsu had established itself as the major competitor to NEC in the Japanese market.

2.4 Global Competitiveness

Rather than use their insulated home market as a profit sanctuary from which to invade foreign markets, Japan's leading computer makers --Fujitsu, Hitachi, and NEC-- spent the first decade of the PC revolution fighting over the Japanese market. The only exception was Toshiba, which successfully targeted the global market with its line of portable PCs. However, Japan's PC makers might yet make their presence felt in the United States and other markets in the 21st Century. Having driven the foreigners back from the ramparts of their domestic market, the Japanese vendors ventured into the U.S. market in 1997. Fujitsu and Hitachi established product development and assembly facilities in California to design and produce notebook PCs for the U.S. market. Consumer electronics leader Sony introduced multimedia PCs made by Intel for the U.S. market, hoping to position itself for the convergence of computers and consumer electronics. Toshiba began to move beyond its niche in notebook PCs by

introducing a multimedia desktop PC for consumers in the United States in 1996 and followed with a line of desktops and servers for the business market in 1997. NEC went a step further and purchased a controlling interest in the U.S. PC maker Packard-Bell, which had used low-priced machines to take first place in the U.S. consumer market but had nearly gone bankrupt doing so. The Japanese vendors also abandoned many of their domestic suppliers and began tapping the global production system to cut production costs.

Failures in Soft Wars

While the Japanese hardware industry has had mixed success in the PC era, the software industry has been an almost unqualified failure. The software and information services market is actually very large, totaling US$41.8 billion in 1995 210.6 billion in 2000. However, packaged software accounted for only 23.6% of the Japanese software and services market, with users still relying largely on custom programs. In comparison, packaged applications accounted for more than 37% of U.S. software and services spending in 1995.14 The balance is now shifting in Japan as PCs become more widely diffused in 2000 and 2001, but the slow adoption of packaged software was detrimental to the Japanese software industry.

Packaged software can be commercialized and exported, while custom software is written to the specifications of a particular user. Producing packaged software is also an effective use of programmers' time. While a custom program will be written once and used by one customer, a packaged product will be written once and used by thousands or even millions of users. So far, Japan has been unable to develop an internationally competitive software industry. In 1995, Japan ran a US$3.9 billion trade deficit in computer software (excluding games).15 Japanese software makers are unable to compete effectively even in their domestic market. More than 60% of the packaged software sold in Japan is imported, mostly from the United States.16 This is surprising because domestic producers should have an advantage in a local market, especially one with a unique language. Yet foreign producers have been able to adapt their programs to the Japanese language and market. Much of the PC software market is dominated by Microsoft, which not only controls over 80% of the operating systems market, but also has a majority of the office suite market with the Japanese version of Microsoft Office. Oracle also has made large inroads into the Japanese market, gaining

more than 40% of the corporate database market in competition with proprietary products from Fujitsu and other Japanese vendors.

U.S. Standards Make Japan Dependant

The inability of Japanese companies to control any of the major architectures for hardware or software has plagued the industry from the beginning. Mochio Umeda argues that while Japanese companies know how to manufacture, they lag behind American firms in knowing what to manufacture, allowing the United States to maintain its control over key standards. For instance, Japanese mainframe makers had caught up with IBM in performance by the early 1980s but still depended on IBM standards and were forced to make large royalty payments to IBM. Japanese supercomputers had surpassed U.S. machines in some speed benchmarks by the late 1980s, but the large library of software available for Cray supercomputers allowed Cray to maintain its lead in the commercial market. The pattern repeated itself in the PC industry, where Japan's development of incompatible PC architectures left it isolated from international standards that were controlled by U.S. companies. Dependence on U.S. standards has trapped the Japanese computer industry in the decreasing returns segments of the PC industry. While Japanese companies do hold near-monopoly positions in some profitable upstream technologies, they have been unable to break into the large increasing returns markets for software and microprocessors. Even NEC's proprietary PC-98 architecture was based on Intel chips and Microsoft's operating system. NEC was unable to protect its PC standard when IBM and Microsoft created open standards for the Japanese market.

Japan's dependence on Microsoft's software standards is not surprising, given its general weakness in software. Somewhat more surprising has been the failure of Japan's semiconductor industry to break Intel's control of the microprocessor market. Each of the major Japanese PC platforms was based on Intel processors, but there once appeared to be a good possibility that the Japanese could eventually challenge Intel's leadership. For instance, while NEC used Intel chips in the PC-98, it also developed its own version of the 80X86 chips, called the V-series. Intel sued NEC for patent infringement, but in 1989 a U.S. court ruled against Intel, opening the door for NEC to sell its V-series processors to any PC maker. At the time, many in the United States predicted that the Japanese, no longer blocked by legal challenges from Intel, would

overwhelm the U.S. microprocessor industry. Japan's dominance of the DRAM industry was expected to give the Japanese chipmakers a critical advantage in achieving higher yields and lower production costs by applying process technologies developed for DRAM production. NEC was not the only likely challenger; Fujitsu, Hitachi, and Toshiba all had experience as second source producers of earlier Intel or Motorola processors and were licensing new RISC designs from U.S. companies. When they tried to challenge Intel, however, Japan's chipmakers came up against the power of increasing returns in the form of Intel's control of the x86 standard. NEC's V-series chips never caught on with PC makers, and by 1993 the company had stopped using them even in its own computers.

The second category of explanations focuses on the dominance of the Japanese economy by the giant keiretsu, who control access to capital and distribution channels. This argument is supported by the example of NEC's use of an extensive distribution channel to dominate the PC market. However, this does not explain the absence of export-oriented start-ups, since the keiretsu's distribution channels did not influence international markets. Why were small Taiwanese companies able to develop linkages to the global production network, while small Japanese companies were left out? It is not surprising that existing small companies remained tied to their parent companies' domestic production chains, but why the lack of newcomers to test the international waters?

2.5 Industry Structure for Software

The entire Japanese computer industry has been hobbled by its weakness in software, and the problem has been especially serious in the PC industry. While Japan's software industry is said to outperform its U.S. counterparts in some measures of programmer productivity and quality control, it has grown more slowly and is less innovative than the U.S. industry. Perhaps the most serious problem is that Japan has failed to develop a vibrant independent software industry able to produce a broad variety of commercial software packages for the PC. There are few Japanese equivalents to independent U.S. firms that dominate the global packaged software industry-and which now control more than half of the Japanese packaged software market. By contrast, most independent Japanese software firms are relatively small and sell only to the domestic market.

Some of Japan's software problems are the result of the evolution of the industry. Japan's computer makers originally sold software and services in conjunction with hardware sales, just as IBM had before it unbundled its software and hardware in 1969. The Japanese government required unbundling in 1977, but the practice of treating software as part of the hardware package remained common, hindering the growth of an independent software industry. Instead, most software was developed either by the hardware makers, their subsidiaries, or by users themselves. In each case, the focus was on custom software, either to lock in customers to the vendor's proprietary hardware or to offer users a perceived competitive advantage in their own industry by developing software tailored to their business processes.

The custom approach created problems for the Japanese software industry. Custom programming is labor intensive and exacerbates the critical shortage of software personnel. If a Japanese programmer can produce more lines of code per hour than an American programmer, it would appear that the Japanese programmer is more productive. But this calculation is deceiving. If the Japanese program has only one user, while thousands use the American program, the American programmer has actually been thousands of times as productive in terms of the value of his or her output. Also, the claims that Japanese programmers deliver code with fewer errors is misleading, since Japanese programmers are often making minor modifications on existing programs, while American programmers are more likely to be developing new products or major modifications of old programs.

The custom software approach led to a rigid division of labor coordinated by hardware vendors and large users. In the beginning, vendors would assign personnel to the user site to develop custom programs and train the users' own information systems departments. Over time, both vendors and users began to spin-off their application developers into subsidiaries that now dominate the software and systems integration business in Japan. These include vendor spin-offs such as Fujitsu FIP, Hitachi Information Systems, Toshiba Information Systems, and NEC Software, and user spin-offs such as NTT Data Systems, Nomura Research Institute, and Nippon Steel Information Systems. While hardware vendors keep operating system development in-house, the vendor and user spin-offs coordinate and develop most applications, contracting lower level activities to independent software houses, which subcontract work to even smaller firms. Software development is implemented through a top-down,

centrally coordinated management system that bears a strong resemblance to Japan's manufacturing structure. Japanese companies treat software production as a factory operation, breaking development down into a linear progression of planning, design, system engineering, and coding. This process creates coordination problems and discourages creativity throughout the system.

Another problem is that custom programming is focused on the mainframe and minicomputer markets, and the skills required to develop and market custom programs do not translate easily to the rapidly growing PC software market. Packaged software requires a focus on creating products that are valuable to a large number of users, which is contrary to the idea of developing customized solutions to a specific user's needs. The inability of older software companies to make the switch to the PC market would not be a problem if new independent software houses were able to meet the demand for packaged software. But while many software vendors did spring up to develop PC applications, their growth was stunted by barriers related to Japan's industry structure. These include lack of access to capital and barriers to distribution channels.

The shortage of venture capital is especially acute in the software industry. Japan's capital markets lack the knowledge and experience needed to evaluate software makers, whose assets are intellectual and intangible, and whose future profitability is difficult to predict. In the United States, there are venture capitalists that specialize in software companies and have the experience to judge their prospects more accurately. The Japanese venture capital market consists mostly of firms affiliated with banks and securities firms, who tend to invest in more traditional industries. In 1989, only 0.04% of total investment by venture capitalists in Japan went to the software industry, compared to 11% in the United States.

There has been some effort by the government and banks to increase venture capital investment in software. The government has offered grants and loans to software companies with innovative products, although many argue that these are little more than bailouts to small subcontractors who have been squeezed by the recession. Also, software distributor Softbank has offered to help private banks screen software companies for investment. Softbank is one of the few big entrepreneurial success stories in the Japanese computer industry, but it remains to be seen if it has good instincts in the venture capital market. The software industry also suffers from

shortages and poor deployment of human resources. Most computer science graduates end up in large hardware firms. Software firms therefore are usually left hiring people with no training in computer science, which they then must train as programmers. The small independent companies at the bottom of the software production chain are given such specialized tasks to perform that their staff is unlikely ever to gain the breadth of experience needed to take on more complex tasks. These companies find it difficult to hire or develop the skilled people that they would need to move into development of packaged programs. The training and personnel management in Japanese software companies tends to stifle creativity as well. New hires are all trained in identical programs, regardless of their previous education or experience, and the practice of seniority-based promotion does not reward a programmer's productivity or creativity.

Finally, software is simply not highly respected as a product in Japan. The tradition of bundling hardware and software caused both vendors and users to undervalue software, since it was not paid for separately. As a result, software professionals do not receive the respect given to hardware specialists. They generally do not receive top salaries, nor are they likely to rise to top management positions in major corporations. This discourages bright students from studying for careers in software. Likewise, Japan's highly regimented software industry has not produced any equivalent to Microsoft, Adobe, Novell, or other successful software start-ups in the United States. With few exceptions, the best-known companies and recognizable individuals in Japan are on the hardware side. As one software professional put it, "Software is not respected. It is not a good job to have because software people cannot be promoted to the top." Such factors have been obstacles to the development of Japan's software industry. Most important, these factors have severely stunted the growth of independent software companies producing packaged software. The weakness of Japanese packaged software is most vividly illustrated by the fact that over 60% of the packaged software market consists of imported programs. Add to that the large amount of pirated software in use, most of which is undoubtedly foreign in origin, and it is clear that very little of the software running on Japanese PCs originated in Japan. Software and information services are the fastest growing segments of the IT industry, and will become even more important as national and global information infrastructures are developed.

The big beneficiaries of the shift to PCs and packaged software have been U.S. companies. Microsoft dominates the market for PC applications and Oracle is now the number one seller of database packages in Japan, competing against the proprietary products from Fujitsu and Hitachi. Developers of packaged software for the PC98 platform now find their DOS-based applications obsolete and they must compete with giants like Microsoft in the Windows market. And while the big U.S. vendors have the resources to develop Japanese-language versions of their products, few Japanese firms can develop and market products for international markets.

2.6 Domestic Market: Slow Adoption of Information Technology

Japan is an advanced user of some technologies, such as on-line banking systems, but it is far behind in implementing client-server computing, local area networks (about one-fourth the U.S. level), and the Internet (one-tenth the U.S. level). Internet mania finally arrived in 1995, but the high cost of telecommunications and access services limited the diffusion of Internet use in Japan. The greatest benefits from PCs come when they are connected together in a network, creating "network economies" that can only be achieved when a significant number of computers are linked together. Japan has been slow to realize these benefits.

The Japanese market has been conservative, lagging behind the United States in shifting from mainframes to PCs and adopting the Internet. This is partly because computer vendors did not encourage users to give up their expensive proprietary mainframes for cheap PCs. It is also due to the conservative nature of user organizations. Big companies were accustomed to centralized computing systems, and there was no ground swell from individuals or departments demanding PCs on their desktops. The PC was seen by users as a tool for secretaries, not managers, and communications systems such as e-mail were seen as impersonal and difficult to use with Japanese characters.

The conservative use of computers in Japan has limited the country's ability to achieve productivity gains by applying information technology. The muted competition in the PC market before 1992 also put the computer makers at a competitive disadvantage internationally. Japanese PC companies were not able to use the domestic market as a base for developing competitive products as they had in other industries, such as consumer electronics and automobiles. With the Japanese PC market

fragmented among different standards and limited by high prices, no one could achieve economies of scale. Nor could they export the products they sold in Japan, since they were not built to international standards. Rather than an asset, the domestic market became a distraction that kept the Japanese industry from focusing on the U.S. market, where technology trends and standards were being set. The protected, profitable domestic market was big enough to support a few PC companies, reducing the imperative to do battle in more competitive global markets. This contrasts with Taiwanese companies such as Acer, which could not survive off the domestic market and so were forced to think globally.

The costs of a backward domestic market were even greater for the software and services industries. Close interaction between producers and sophisticated users is critical in the software development process. For instance, the alpha and beta testing of new software generations provides invaluable feedback to software developers on the features desired by users and helps eliminate bugs before the program is commercialized. Sophisticated users also find new applications for programs that help expand the market for a product. In the rapidly growing systems integration industry, interaction between providers and users is vital to improving the knowledge and capabilities of both parties.

The PC boom of the mid-1990s helped bring Japan closer to international levels of computer use. With PCs, networking, and Internet use became more widespread by 2000, Japan finally came more into the mainstream of the global computer market. This change may still help Japan reap productivity gains in industry and government by 2004. NEC giving up the PC98 system and the unification of much of the Japanese PC industry around the Wintel standard made it more competitive internationally in hardware, but the prospects for the software industry are less promising.

Human Resources

Japan has a large, high-quality pool of engineers to support its electronics and semiconductor industries, with particular strength in process engineering. Japanese universities granted 81,355 bachelor's degrees in engineering in 1990, compared to 64,705 for the United States. Japan only produced 1,370 doctoral degrees in engineering, compared to 5,696 in the United States. Hardware skills such as electronics engineering have long been in high demand by the big electronics firms, which offer

good salaries, job security, and prestige. This has lured top students into such fields, and the flow of top students into such companies has reinforced their competitive edge.

On the other hand, Japan has a serious shortage of computer professionals. While the number of software professionals as a share of total population in Japan is comparable to the United States, there is a much lower level of university-trained computer specialists. The number of graduates with bachelor's degrees in math and computer science was just 3,125 in 1990, compared to 42,369 in the United States and this trend continued through the 90's affecting the IT industry severely. It is estimated that only 20% to 30% of the courses offered in Japanese computer science programs are comparable to courses in the U.S. standard ACM curriculum. 83 The situation is worse in advanced degrees. Japan has never produced more than 88 doctoral degrees in math and computer science in a single year, while the United States produced 2,024 in 1993 alone. Japan has also sent far fewer students to the United States for graduate degrees in science and engineering than have other Asian countries such as China, Korea, and Taiwan.

Most of the small number of computer science graduates ends up working for major hardware vendors or large software firms, leaving the rest of the industry to get by with university graduates from other majors and graduates of vocational schools, two-year colleges, technical schools, and high schools. Also, many Japanese business and media pundits seem unaware of the huge discrepancy between the quantity and quality of graduate education when comparing Japan to the USA, Britain, or Taiwan. User organizations likewise have a limited pool of professionals to draw upon. Most computer skills are developed through on-the-job training, and few companies provide workers with systematic outside training in computer skills and Japan rarely issues H1 or V1 Visas to highly educated foreigners to fill these positions as is done frequently in the USA, Britain and Taiwan when there is a demand.

The lack of job mobility between Japanese companies often makes it difficult for companies to get experienced workers and limits the dissemination of skills throughout the industry as well as making it virtually impossible to make quick transitions in human resource strategy according to market conditions. Also, the job status and compensation offered by the larger companies can not be matched by small companies, making it difficult for more dynamic small companies to get the skills they need to succeed. Strict limits on immigration into Japan shut off a supply of skilled foreign

workers that has been very important to the U.S., Canada and Taiwan PC industries as mentioned above. The shortage and poor deployment of human resources is an obstacle to Japan's ability to compete in computer systems, develop an independent software industry, and effectively apply computers throughout the economy efficiently. Not only does Japan need more computer professionals, it also needs to increase the computer literacy of its entire workforce, from top management to the shop floor.

2.7 Conclusion

Japan and other countries such as Taiwan and Singapore have taken largely different paths for the same policy goals mainly due to the institutional differences caused by different structures in business, state, and NGO sectors. These institutional differences in a combined way affect the interactions between the core players in the state and society and also affect the path dependency and options for their respective organizational strategies. By showing the different organizational strategies that were formulated and implemented by the states in Japan and other countries, and by uncovering the causes of such variation, this research argues that the state and state-society relations in the development of organizing institutions for all sectors (institutional development in particular) vary through time, across societies, and across industrial sectors according to indigenous circumstances. Once economic backwardness has been overcome to a certain extent, institutions in the state-business and state-society relations that have been formulated throughout the developmental process may vary across societies and across industrial sectors and also time. Different institutions, in turn, affect the interactions among the people involved in the policy-making process as well as in interest group representation in a given society, which may result in different political and economic outcomes as shown above.

The combination of industry structures, domestic markets, and national capabilities (especially human resources) explains why Japanese companies thrived as producers of high-volume hardware and became competitive in the mainframe business, yet struggled in PCs and software. The closely integrated keiretsu industry structure provided ready capital, reliable supply chains, and captive customers. The domestic market also served as a proving ground for both consumer electronics and electronics components that could be exported in high volumes. However, both producers and users were slow to react to the PC revolution on a large scale and cost effective way.

Vertical integration and lack of new ventures left Japan partly isolated from the dynamic global production system for PC hardware. Software factories were of no use in creating packaged software. Entrepreneurial start-ups were starved for capital and access to distribution channels because there was no venture capital market per se. Also, engineers, programmers, and other professionals were trained to be average, and they were lured into large organizations that offered prestige but discouraged innovation. Only in the 1990s, faced with a slump in the entire electronics industry, did Japanese companies begin to make changes in their corporate cultures and practices, and these changes have been very slow at best.

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